SYMONS'S

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THE LATE FROST.

THE cold period in December was noteworthy rather on account of its duration, and the very fine specimen of a silver thaw with which it terminated, than for individual cases of extreme cold. But so many of our correspondents have favoured us with accounts that it would be as ungracious as it would be unwise to omit them all, because in some previous years lower temperatures have occurred.

The data have been arranged in the following order :—

I.—Letters printed *in extenso.*

II.—Table of max. and min. temperatures for 12 days at seven widely spread stations.

III.—List of lowest temperatures in the late frost.

IV.—List of lowest temperatures in the frosts of 1860, 1867, 1869, 1870 and 1874.

V.—A few words about the silver thaw.

SIR,—The following are abstracts for December, 1874 :—Temperature—max. 51° on 8th, min. 15° on 23rd ; frost on 22 nights, on grass on 29. The min. temp. was below 20° on 5 nights, on the grass on 10. The min. on the grass (snow) was 6° on 23rd, 7° on 31st, 9° on 22nd and 30th, 11° on 20th, 12° on 3rd, 14° on 28th, and 17° on 2nd and 26th. The frost, although it lasted from the 14th, has not been remarkably severe in this locality, the only day on which the 9 a.m. reading was below 20° was the 23rd, on which day it was 16°, and on several days the reading ranged from 20° to 32° ; the max. on 31st was only 25°·1, and on 23rd 26°·5.

Snow fell heavily on 11th, 16th (11 in.), 18th, 19th and 24th, and slightly on 2nd, 13th, 14th, 17th, 21st, 22nd, 26th, 28th and 31st.

Heavy snow fell last night, from 5.30 to 7 p.m., followed by heavy rain, which produced a silver thaw, and freezing on the hardened snow made travelling almost impossible; it is, however, thawing rapidly to-night.—Yours truly, THOS. PAULIN.

Enfield Chase, Enfield, 2nd Jan. 1875.

SIR,—The long frost of the past month has now completely broken up, the rise of temp. from the 1st to the 3rd inst. having been very great.

The min. on the night of Dec. 31st-Jan. 1st, was only 17°·2 in the air, and 15°·8 on the grass, the max. in the air on the 3rd was 50°·9 about 9 a.m. Small globules of frozen rain fell in showers from 4 to 7 p.m. on the 1st, followed by rain, which froze upon the surface of the ground and snow till 11·30 p.m., when the temp. rose to 34° in the air, and the thaw became general. At 9 p.m. the air temp. was, dry bulb 32°·3, wet 31°·7, and on grass 31°·8, all objects out of doors being covered with a sheet of ice one-tenth of an inch thick, and extremely slippery. At 9 a.m. on 2nd I registered 0·31 in. of rain, and the temp. had risen to 40°, and most of the snow had disappeared.—Yours very truly, EDWIN E. GLYDE.

Forest Hill, S.E.

SIR,—The past month, Dec. 1874, was the coldest one for 14 years. The mean temp. was 31°·5, or 7°·6 below the average. Frost occurred on grass on every day except the 9th. The mean of min. on grass was 23·7.

The greatest cold commenced on 22nd, and I herewith give the readings, which require little comment:—

	IN SHADE.		ON GRASS.
	Max.	Min.	Min.
1874—Dec. 22	27°·8	24°·2	21°·3
,, 23	33 ·7	17 ·0	15 ·0
,, 24	33 ·8	19 ·2	16 ·3
,, 25	33 ·8	31 ·5	30 ·8
,, 26	32 ·6	18 ·0	16 ·0
,, 27	33 ·3	22 ·7	20 ·2
,, 28	27 ·5	16 ·5	14 ·5
,, 29	26 ·0	14 ·0	14 ·4
,, 30	26 ·0	14 ·5	13 ·0
,, 31	26 ·7	18 ·2	16 ·0
1875—Jan. 1	35 ·0	11 ·8	12 ·0
,, 2	39 ·8	27 ·2	26 ·0

The lowest readings of the dry and wet bulbs at 9 a.m. occurred on 30th Dec. viz., 16°·1, 16°·0.—Very truly yours, SAML. H. MILLER.

Wisbeach, 8th January, 1875.

SIR,—I omitted to give you a remarkable depression of the thermometer on the night of December 30. At 11 p.m. it stood at 24° with cloudy sky; the three or four previous nights having been similar in all respects; the sky, however, cleared for a short time—how long I do not know, and the minimum proved to be 2°·25, and at 9 a.m. it stood at 12° and then rose rapidly to 32°. I could not believe in the reality of such a fall until I found it was confirmed by two thermometers in Hereford, one of which fell to 3°·5, and another to about 5°.

My thermometer is a good one, tested at Kew, and stands in a proper thermometer stand at about 4 ft. from the ground.—Faithfully yours, HENRY COOPER KEY.

Stretton Rectory, Hereford, Jan. 4th, 1875.

SIR,—Mr. Brumham's prophecy that the winter of 1874–5 "will

be, at any rate, partly very severe," is likely to prove correct, as the cold continues.

The frost in this part set in on December 14th, and has lasted as yet to the month's end with but little intermission. Snow fell here during the night of the 15th and morning of the 16th, and covered the ground to a depth of about seven inches on the level, and on the 18th we experienced a very severe frost, which appears to have been rather local, as I did not see anything like so low a temperature noted at 8 a.m. at the different places given in the meteorological reports, published in some of the London daily newspapers. On the 18th, at 8 a.m., my thermometer, (one of Negretti and Zambra's), placed 4 ft. from the ground, with a north aspect, read as low as + 8·5 deg., or 23·5 deg. below freezing. It was a calm morning, with a few clouds about and haze around the horizon. During the day the temperature rose considerably; at 9.30 a.m. it was 14 deg., and at 5.30 p.m. it was 25·5 deg.; at 7 p.m. 30 deg., and by 8 p.m. had risen to 32 deg., when some freezing rain fell, and the wind blew lightly from the S.W., and a thaw occurred during the night, and the next morning, the 19th, the temperature at 8 a.m. was 38·5 deg., being a rise of 30 deg. during the 24 hours. The frost last night was again very severe; the thermometer this morning at 8 a.m. was 21 deg.—I am, yours faithfully, ARCHDALL E. BUTTERMER.

Staunton, near Gloucester, Dec. 31st, 1874.

SIR,—We had a fine example of a "silver thaw" here, as elsewhere, on the 1st. Snow began at 3 p.m., when the thermometer had risen to 27°, (on the previous night it had fallen to 10°, the lowest point attained here during the frost); at 4 p.m. the snow very suddenly changed to hard rain, mixed with ice crystals. The rain continued to pour down until after midnight. At 11.45 ·40 in. had fallen, as far as I could measure it, but the state of the gauge precluded accuracy. The thermometer stood at 30° till 10 p.m. and rose to freezing point at midnight, when everything had become a sheet of smooth, glassy ice. During the night the thermometer rose to 41°.

The 1st was remarkable for the great difference of direction in currents of only slightly differing altitudes. Cirrus moved from W.N.W., but *low* clouds travelled very fast from *S.S.W.*, while on the earth's surface the E.S.E. wind held all day, and blew roughly (about force 6) in the evening, scarcely veering to S.E. till midnight.—Yours sincerely, W. CLEMENT LEY.

Ashby Parva Rectory, Lutterworth, Leicestershire, Jan. 6th, 1875.

SIR,—Perhaps a note of the severity of the frost here may be useful for purposes of comparison.

The values of the dew-point below 10° are calculated on the supposition that Glaisher's factor would 8°·8, the tables not extending so low. But I doubt the accuracy of the tables. M. August's formula gives *higher* values. I had my little pocket dry and wet thermometers (which are good instruments) out: the dry agreed with the other dry, and I com-

pared the two wet bulbs together at about 5°, taking the higher value as most probable—cold work too!

	9 a.m.		9 p.m.		Read at 9 p.m.		
	Dry bulb.	Dew point.	Dry bulb.	Dew point.	Max.	Min.	Min. on grass.
December 22	18°·3	15°·8	12°·2	10°·4	30°·6	11°·4	+ 3°·0
,, 23	23 ·8	16 ·9	22 ·6	15 ·3	28 ·6	10 ·7	+ 1 ·2
,, 28	...	...	5 ·3	— 5 ·2	26 ·2	5 ·3	+ 2 ·0
,, 29	23 ·3	21 ·9	15 ·8	+ 4 ·4	24 ·8	5 ·5	+ 2 ·0
,, 30	6 ·8	— 9 ·0	19 ·0	+13 ·3	20 ·8	5 ·2	+ 3 ·0
,, 31	5 ·8	— 1 ·2	4 ·7	— 2 ·3	22 ·3	3 ·3	— 6 ·0
January 1	15 ·0	+15 ·0	..	...	...	1 ·9	— 6 ·0

The mean for December is 28°·25—the coldest *calendar* month I have ever registered. The "storm" has now continued with two brief intermissions since November 25th, and the farmers are at their wits' end to fodder their sheep.

At the time of writing everything is frozen that can be. The waterfalls present a most extraordinary appearance, being covered with ice apparently yards in thickness, and only a small channel in the middle remaining for the water, which is scarcely to be seen at all.—F. W. Stow.

Hestholm, Bedale, Jan 1st.

P.S.—Near Bedale,—3° is said to have been registered at 4 ft. This is probably correct. Also,—8° in Swaledale, below Richmond, but I do not know on what authority. At Penrith +2° was the min. on 29th, and +4° on Jan. 1st, and the ther. fell 7 times below 10° in Dec., the mean being 28°·0. Ullswater was a magnificent sheet of ice a foot thick. (Thermometer in a Stevenson).

Extract from Meteorological Register at Mellington Hall, Churchstoke, Montgomery.

	Dry Bulb.	Wet Bulb.	Min. 4ft. above gd.	Grass Min.	Max.	Solar Rad.
1874.						
December 28	31°·0	31°·0	28°·5	27°·0	35°·0	77°·0
,, 29	27 ·5	27 ·0	21 ·5	21 ·5	30 ·5	33 ·0
,, 30	24 ·0	24 ·0	21 ·5	23 ·0	31 ·0	55 ·5
,, 31	18 ·0	18 ·0	1 ·5	4 ·0	25 ·0	55 ·0
1875.						
January 1	30 ·0	30 ·0	16 ·0	11 ·0		
,, 2	42 ·0	42 ·0	34 ·0	30 ·5		

Instrument stand 4 ft. above ground, and on level open ground.
Observations taken at 9 a.m. and 4 p.m.
Thermometers verified at Kew.

Philip Wright, F.C.S.

To the Editor of theMeteorological Magazine.

SIR,—The cold has been so intense in this district during the month of December (just passed) and the first two days of January, 1875, that I thought a brief account might not be uninteresting to you and the readers of the *Meteorological Magazine*. The frost gradually increased in severity towards the end of the month, until the mean temp. of the last week was not higher than 20°·02. Snow fell frequently and remained on the ground for several weeks, and the ice on the lakes has been from eight to ten inches in thickness.—I remain, yours faithfully, EDWD. TUCKER, junr.

Woodlands, Elterwater, Ambleside, Jan. 4th, 1875.

Date.	Air min. in shade.	Grass min.	Temp. at 8 a.m.	Max. temp. in shade.
1874.				
Dec. 21	30°	24°	34°	37°
,, 22	20	16	20	36
,, 23	11	9	12	32
,, 24	17	15	31	35
,, 25	25	20	26	30
,, 26	14	11	26	33
,, 27	15	11	18	29
,, 28	14	9	16	27
,, 29	10	5	21	26
,, 30	6	3	10	24
,, 31	7	4	8	24
1875.				
Jan. 1	7	*4	24	42
,, 2	29	26	40	47

Height above Sea Level at which observations were taken, 290 feet.

* A thermometer placed about 80 ft. lower down in the valley indicated 2° below zero the same night.

Extremes of Air Temperature Dec. 21, 1874, *to Jan.* 1, 1875.

Date.	London, Camden Sq.		Worthing.		Wolverhampton.		Bucknall, Horncastle.		Brinkburn.		Elliston. St. Boswell's.		Cargen.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.	deg.
Dec. 21	34·1	28·4	35·3	27·5	36·7	22·5	32·0	23·0	33·0	18·0	35·0	26·0	37·5	26·7
22	31·8	22·7	31·0	22·4	30·0	18·2	31·0	19·0	24·0	14·0	35·0	16·0	36·7	23·5
23	28·2	18·4	33·0	21·0	33·8	20·1	28·0	12·0	25·0	12·0	32·0	17·0	27·5	14·7
24	36·2	19·5	41·9	21·4	35·2	21·0	34·0	14·0	35·0	22·0	31·0	22·0	35·9	26·9
25	36·2	33·3	37·0	32·3	36·7	31·8	32·5	31·0	30·0	11·0	28·0	15·0	34·1	24·5
26	33·1	24·8	35·0	29·5	36·4	25·4	29·5	12·0	30·0	14·0	32·0	17·0	29·1	17·7
27	34·1	27·6	35·3	29·2	31·8	25·3	29·0	21·0	28·0	14·0	33·0	18·0	23·5	10·5
28	33·8	27·2	37·9	28·0	32·1	26·8	29·5	7·0	25·0	2·0	27·0	12·0	20·5	9·5
29	32·4	25·4	34·2	27·7	28·0	25·0	28·0	18·0	25·0	0·0	16·0	4·0	25·1	11·5
30	30·1	19·1	35·0	24·9	27·5	20·5	23·0	4·0	20·0	8·0	20·0	4·0	25·5	9·5
31	24·3	19·0	30·2	26·4	28·0	15·7	27·0	15·0	20·0	—4·0	24·0	11·0	29·5	17·5
Jan. 1	33·0	20·7	...	...	39·4	17·4	29·0	14·0	...	...	27·0	4·0	...	...

Minimum Temperatures, December 1874, *and January* 1875.

[Not quoted elsewhere in this article. Others will be found in the preceding letters and tables, in the following comparison, and also in the tables and remarks on pp. 189-192.]

Cranbrook.....	9·0	1st.	Leeds	4·0	30th & 1st.
Eltham	15·1	30th.	Barnard Castle	2·0	1st.
Ticehurst	12·8	30th.	Gainford, Darlington	3·0	30th & 1st.
Cambridge ...	15·0	30th.	Eastwood Hill, Glas-		
Tean, Cheadle.	5·0	31st.	gow .....—3·0		26th.
Nottingham...	12·1	30th.	Ostend	15·4	29th.

Comparison of Minimum Temperatures in several Frosts.

	1860		1867		1869		1870		1874
Camden Square	6·7	...	6·7	...	20·8	...	14·0	...	18·4
Greenwich Observatory	8·0	...	6·6	...	21·3	...	9·8	...	18·2
Selborne	—1·5	...	—2·0	..	17·5	..	5·0	...	5·0
Bodmin	14·0	.	11·0	...	18·0	...	15·0	...	30·0
Orleton	3·0	...	1·6	...	10·7	..	4·5	...	8·3
Bromsgrove	0·3	.	2·3	...	7·8	...	5·8	...	4·8
Derby	2·0	...	13·0	...	15·0	...	9·0	...	16·0
Old Trafford, Manchester.....	—3·0	...	8·7	...	13·5	...	—	...	13·2
York	—	...	10·0	...	15·0	...	11·0	...	—
Malton.....	—6·0	...	6·0	...	—	...	3·0	...	1·0
Aberdeen.....	—11·0	...	10·2	...	17·8	...	11·2	...	12·1

Full information respecting these frosts, and some previous ones, will be found in the *Meteorological Magazine*, Vol. II., pp. 3, 11, 18, 94; Vol. IV. p. 185; and Vol. V. pp. 6, 20, 201.

A word or two respecting the "Silver Thaw" of Friday evening, January 1st. The day had, in London (and, we believe, it was similar throughout much of Western Europe), been very dull and cold; about 3 p.m. a few "ice needles"—delicate, but very sharp spiculæ of ice—fell. These changed, about 5 p.m., to clear hard crystals of ice, brilliantly refractive, but of no regular shape, and seldom more than 0·03 in. in any direction. This changed to rain about 6 p.m., though the air temperature remained below 32°, and the ground was, of course, much colder. The result was that every exposed surface and object was coated with clear ice, about 0·15 in. thick—the effect of this upon the roads, &c., may be imagined. One curious instance of the effect of the low air temperature may be worthy of record:—The bow of a bonnet was brought to us, coated with ice, and perfectly rigid therewith, the rain which fell upon it was, in spite of the warmth of the wearer, frozen into ice by the coldness of the air.

How serious were the effects in Paris may be gathered from the following translation from *L'Echo de l'Ostende*:—

"The number of accidents produced by the state of the Paris streets on Friday night is not yet accurately known, but there are already 2,023 reported at the Préfecture de Police. Many are only bruises, more or less serious; but, unfortunately, a great many falls have caused broken limbs, and there are a large number of deaths."

A MAGNIFICENT METEOR.

To the Editor of the Meteorological Magazine.

SIR,—Possibly you may be interested with the following notice of a splendid meteor which I saw last night, at 9h. 15m., while crossing the Roman Road in this road. I stood still and exclaimed aloud, "What a magnificent meteor!" and, I should think, it was visible several seconds, as I seemed to stand gazing at it for some time. The head, or nucleus, was a bright pale blue, much larger than any star, the tail a bright fiery crimson, and yellowish in the interior portion. Its shape was that of a very elongated pear, the eye in front and the stalk behind. Its first appearance was about S.E. by S., at an altitude of about 45°, and it travelled eastward, disappearing about E.S.E. at an altitude of 30°; the stars were shining brightly. You may possibly get some other notices of this meteor, and my account may serve for comparison with them.

Yours faithfully,

R. STRACHAN.

11, *Offord Road, N.*, 15*th Dec.* 1874.

RAINFALL AND YIELD OF WELLS.

To the Editor of the Meteorological Magazine.

SIR,—The facts that have come under my observation up to the end of 1874, have confirmed in a remarkable manner the statements made in the letters you did me the favour to insert in the August, November and December numbers of the *Meteorological Magazine*, in which I wished to show that it was rather the condition under which rain falls, than the yearly amount, by which the subterranean water supply is ruled. The total rainfall registered by me is 21·58 in., or, in round numbers, 4·00 below the average of the last 10 or 20 years, or taking the exact figures for the 10 years, 25·81 against 21·58 in 1874. Then again the rainfall for the last three months (deducting the snow not melted) is as nearly as possible the average depth of the last ten years, whereas the well under my observation stands now 3 feet higher than at this time last year, the average alternation being 8 feet. If the thaw should be rapid, the effect on the water level will be considerable; should this be attended with heavy rain, the stock of water in the earth will, notwithstanding the short quantity of annual rainfall, be in excess of the average. This will be chiefly due to the conditions of the fall in the months of October, November, and December of the year just closed, and not to the yearly quantity.

I am, yours faithfully,

J. C. CLUTTERBUCK.

Long Wittenham, January 1, 1875.

THE ZODIACAL LIGHT, &c.

To the Editor of the Meteorological Magazine.

SIR,—Perhaps the subjoined notes will interest some of your readers. Solar halos have been looked out for every day; the northern sky has been nightly scanned for auroræ. The look-out for the zodiacal light was begun on the 10th of March, and was continued through the spring and early summer; and observations again began in the mornings on the 1st of September. So that as regards solar halos, auroræ and the zodiacal light, these observations may be safely regarded as a fair account of the number of times such phenomena have been visible here.

I may also remark that I was led to watch for the zodiacal light, not like Mr. Plummer (see monthly notices of Royal Astronomical Society, November, 1874), who has been led to suspect maxima and minima, but simply to ascertain whether in this latitude the phenomenon was frequently visible in the early mornings of autumn and winter. I never saw it very distinctly on these mornings owing to the presence of thin clouds, but portions of it were sometimes quite as bright as in the March twilight.

Parhelia were seen on May 1st.

	Halos.	Auroræ.	Lunar Bows.	Zodl. Light.
January	1	4	1	—
February ...	2	3	—	—
March	6	—	—	4
April	13	—	—	—
May	7	2	—	—
June	13	6	—	—
July	3	2	—	—
August	1	—	—	—
September ..	2	—	1	2
October	—	2	—	6
November...	5	—	—	3
December ...	—	—	—	—
	53	19	2	15

I am, Sir, yours truly,

JOSEPH GLEDHILL, F.R.A.S., F.G.S., &c.

Mr. Edward Crossley's Observatory, Halifax,
Dec. 17th, 1874.

REVIEWS.

Charts of Meteorological Data for Square 3, *Lat.* 0°—10° *N., Long.* 20°—30° *W.*

Remarks to accompany the same. Published by authority of the Meteorological Committee. London: E. Stanford. Folio and quarto.

CAPTAIN TOYNBEE has had a difficult task before him in preparing these handsome works, because he has had to please two classes of readers distinct in their wishes, ideas and modes of life, and yet two classes one of which often merges into the other; for a steadily

increasing number of our naval men are claiming a position as men of science.

We are by no means sure that anyone would have steered a middle course more judiciously than Capt. Toynbee has done, and we think that on the whole the course adopted is the best. It is quite true that for the purposes of navigation a large proportion of the information given is superfluous, but on the other hand it must not be forgotten that these very data are essential to meteorological work, and if that portion which may be described as navigational had been issued separately, many captains might have jumped to the false conclusion that that class of data was alone essential, and have grown careless in keeping their records of other phenomena. Now, however, that the complete work has been issued, we think it might be well to prepare an epitome of those portions which partake of the nature of sailing directions, taking care in the preface to call attention to the desirability of captains filling in their logs as fully as possible, and to the fact that the completeness of the larger work, and the consequent accuracy of the smaller, had been greatly increased by records of many data not mentioned in the lesser one.

We must, however, pass on to the charts. We do not attempt to tell our readers what they contain, for they are crammed so full of facts that without reprinting them in fac-simile it would be impossible to explain them. Moreover, to those who have copies such description is useless, and to those who have not, it would be little better. They appear to us very good, but we are sorry to see that the very simple plan of feathering the arrows to indicate the maximum strength of wind recorded from each point has not been adopted; to a thoughtful mind the present arrow heads express nothing more than if they were all removed, and thus an important item might have been added without much trouble, and with good effect. The shape of many of the isobars is very remarkable, and we think it would have been well had the twelve monthly diagrams been reimposed on a single page of the remarks, in order to facilitate tracing the sequence of monthly changes. It is, however, a bold step to draw isobars for hundredths of an inch from ship observations, and some eccentricity in the curves was to be expected rather than wondered at.

On comparing the data now published with some of the best previously accessible we find very satisfactory agreement. This is the case as to the surface temperatures, as given in Keith Johnston's *Physical Atlas*, except perhaps that his "Oceanic Warmth Equator" of 82° is slightly too high. The remarkable skill of Dove in drawing accurate conclusions from slight data is shewn by the remarkable agreement between the curves in his *Die verbreitung der wärme auf der oberfläche der Erde*, published in 1852, and those now deduced. The same may be said of the January barometric curves in Buchan's *Handy-book of Meteorology*, 2nd edition; but his July curves will require considerable alteration, and herein is a proof of the utility of the present publication.

It is too bad of Captain Toynbee, after the long discussion in our pages,* to spell Equatorial on the very first page of his remarks with two e's; it may be only a slip, but it almost looks like a direct intimation of his views on the orthographical question; but, if so, he might have put a foot note to explain why he holds that the termination should (unlike that of almost all words) be "oreal."

There are, of course, a few useless things in the remarks, such as the table of "Falling Stars" on p. 66, but very few, and we know few more thorough pieces of work. There are also a few statements scattered at wide intervals which make us wish that by a reference number we could ascertain who vouched for their truth—*e.g.*, in January, between 5° and 6° N. and 20° and 21°, someone reports "Heavy chain lightning; impossible to see anything for at least *ten minutes* after each flash." But there are fifty statements for which we should like to thank the observers for one which is open to adverse criticism. Here, for instance, is a capital account of a waterspout:—

10 a.m. 11th February, 1871.

A waterspout had suddenly formed within 20 yards of the ship's stern, though its formation was not noticed. It reached the water at an angle of about 30° from the perpendicular, inclining with the wind, though it seemed almost stationary. There was a clear, well-defined, inside space, like the bore of a cannon about 18 inches in diameter, very smooth and, apparently, even. Within it the water revolved rapidly, having an upward, spiral motion, and looking very much like dark smoke. The revolution was contrary to that of the hands of a watch. Its diameter seemed to be about 4 feet. There was but little commotion on the surface of the water, but much in the cloud where the spout joined it. It became disconnected near the water, and rapidly receding upwards into the cloud it soon vanished, but for some time after its disappearance much commotion and disturbance could be seen in the cloud.

Owing to the variable number of observations in different parts of the square it is only possible to determine the area in which exceptional phenomena occur most frequently by noticing the per-centage of their frequency to the total number of observations; judged by this test waterspouts appear to prevail nearly equally in all *parts*, but it is not so for all months, their frequency in winter being thrice that in summer. The total number of sub-squares in which they have been reported is 40, and they are thus distributed over the year:—

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
6	3	4	1	1	2	4	1	0	5	8	5
31					9						31

We are sorry to find in the Appendix another instance which seems likely to lend strength to the prevalent belief that it is a theory of the Meteorological Office, that whatever poor Admiral FitzRoy did was useless. Seventeen pages are devoted to a discussion of the Diurnal Range of Atmospheric Pressure, and yet the only recognition of the Admiral's work on the subject is one line and a half, viz.:—"The investigation is a continuation (on a larger scale) of the work undertaken in the year 1861 by Admiral FitzRoy (Seventh number of Meteorological papers)."

* Met. Mag. vol. viii. pp. 164, 167, 182, Vol. ix. pp. 8, 27.

Considering the number of years this memoir has been in preparation, and the enormously greater pecuniary resources of the office now than in FitzRoy's time, to say nothing of the progress of Meteorology during the interval, it is somewhat superfluous to state that the present discussion is "on a larger scale." On the other hand, a few words of graceful recognition of the fact, that with his far inferior resources Admiral FitzRoy and his assistant, Mr. Harvey Simmonds, had in many respects been wonderfully near the truth, would have been more worthy of both parties.

We have, however, no desire to conclude our notice in a tone of censure; it is a good work, well and thoroughly done, and, as far as we have observed, very free from misprints, and creditable to the office and its marine superintendent.

Nederlandsch Meteorologisch jaarbock voor 1870. *Tweede Deel.* Oblong 4to. Utrecht: Kemink en Zoon.

OUR readers must not conclude that because the above work has only just been issued, Dr. Buys Ballot is far behind with his work. That is not the case, his completed volume for 1873 was on our table early last year, and we hope to see that for 1874 very shortly. The work before us is, in fact, a sort of appendix, and, for all that we can see, might just as well have been called Vol. II. of 1873 as of 1870. However, the title is a very trivial matter, and we gladly pass to the introduction and contents. The former is very clear and to the point; the latter, or rather 145 pages thereof, consists of a very extensive collection of mean monthly barometric values for long series of years at places mostly in Europe, but including a few outsiders such as Funchal in Madeira, and Barnoul in Siberia. As Dr. Ballot is very anxious that any errors which may exist in these tables should be detected, he has printed the monthly means and the decennial average monthly means in the scales employed by the observers, but given also the decennial average monthly means in their metric equivalents. Although at first the jumble of Paris lines, English inches, millimetres and Russian lines, and many of these with different constants thrown off, looked very unpromising, we are inclined to think that Dr. Ballot has adopted the right course, and that if he had converted all the values into any one scale, few observers would have taken the trouble to re-convert his values in order to test their accuracy. On the present plan, they must be hopelessly idle who neglect to verify the printed tables of their own observations.

The work is such a mass of figures that it requires almost as much care in revision as a table of logarithms, and among the hundreds of thousands of figures a few are sure to be wrong; we hope, however, that in page 36 (which we chose hap-hazard as a test) we have fallen on a bad specimen, for, truth to tell, there are three misprints, 1788, August, 30·04 should be 30·00; 1797, May, 29·99 should be 29·93; and 1799, February, 29·81 should be 29·80. There are some very

wide differences between the values given by Dr. Ballot for Sandwick on p. 70, and those given in Dr. Clouston's paper (page 90) in FitzRoy's *Fifth Number of Meteorological Papers.* We do not know which are correct, but both cannot be.

We are painfully aware of the difficulty of doing that perfectly which Dr. Ballot has attempted; he has our best wishes for his success, but we doubt if he has realized the necessity which increasingly exists for keeping down the quantity and improving the quality of meteorological work. Dr. Ballot is very frank in his acknowledgment of the sources of his information, and is well known to be most liberal with his publications; may we suggest that as probably nearly all the contributors of data have received copies of the work before us, it would be well to send a circular to each, informing him that the tables were undergoing final revision, and that any corrections he might forward within two months would be duly noted, and that for all errors not so reported the observers must be held responsible.

We hope that further examination may prove that our selection was exceptionally unfortunate, and that nothing more than a short table of errata is necessary; but, if otherwise, we should very much like to see the decennial averages 1861-70 corrected for altitude, and thrown into a single series. Of course, for Dr. Ballot's special purpose this is not necessary, but he has collected so fine a series of records that we desire to see them utilized in every possible way.

The latter portion of the volume contains the elaborate rain tables, well known to all readers of the *Jaarboek*, and also a reprint of the table of Scotch rainfall, given by Mr. Buchan, in the *Quarterly Journal of the Scottish Meteorological Society*, vol. iii. p. 254, but converted into metric equivalents.

BOOKS RECEIVED.

GREAT BRITAIN.

CAMPBELL, MAJOR W. R.E. A Suggestion for the Flood Relief of the Shannon, *via* Belhavel. Fcap. folio. Dublin, 1874.

Cardiff Naturalists' Society Report and Transactions. Vol. v. 1873. 8vo. Cardiff, 1874.

DONCASTER, D. Mean Monthly Temperature at Sheffield for 1874, as compared with the average of 20 years, 1852-1871, inclusive. Single sheet.

DONCASTER, D. Mean Atmospheric Pressure for 1874 at Broomhall Park, Sheffield, compared with the average of 20 years, 1852-1871. Single sheet.

DONCASTER, D. Total Monthly Rainfall at Broomhall Park, Sheffield, for 1874, compared with the average of 20 years, 1852–1871. Single sheet.

Kew Committee Report for the Year ending October 31, 1874. 8vo.

FRANCE.

BORIUS, M. LE DR. A. Recherches sur le Climat du Sénégal. Ouvrage accompagné de tableaux Météorologiques, de 14 planches dans le texte et d'une Carte du Climat et de l'état sanitaire du Sénégal suivant les Saisons. 8vo. Paris: Gauthier-Villars. 1875

BORIUS, M. LE DR. A. Gorée (Sénégal) Observations Météorologiques faites pendant dix années 1856-1865, par Mm. les Pharmaciens de la Marine. [From Annuaire Soc. Mét. de France.]

MARIE-DAVY, M. Bulletin Mensuel de l'Observatoire de Montsouris, Sept. to Nov. 1874. 4to.

DECEMBER, 1874.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32° In shade	On grass
			inches	inches.	in.								
I.	ENGLAND.	Camden Town	1·58	+ ·08	·52	8	14	53·8	6	18·4	23	21	26
II.		Maidstone (Linton Park)	2·95	+ 1·12	·64	17	15	52·0	6, 7	12·0	31	27	...
,,		Selborne (The Wakes)	3·32	+ ·57	1·04	8	14	56·0	11	5·0	31	25	27
III.		Hitchen	2·07	+ ·76	·62	8	18	48·0	6	13·0	29†	28	...
,,		Banbury	1·81	+ ·14	·47	8	15	50·0	6	13·3	30	27	...
IV.		Bury St. Edmunds (Culford)	2·17	+ ·68	·61	6	14	51·0	6	6·0	31	26	30
V.		Bridport	4·07	+ ·70	·86	23	15	55·0	6	20·0	3. 23	23	..
,,		Barnstaple	7·10	+ 3·98	·76	29	22	54·0	6, 7	24·0	23	...	...
,,		Bodmin	7·26	+ 2·02	·90	10	26	52·0	6	30·0	3	9	13
VI.		Cirencester	2·78	+ ·49	1·00	8	7	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	2·43	+ ·75	·64	15	14	49·0	6	14·0	31	26	28
,,		Tenbury (Orleton)	2·83	+ ·37	·85	15	16	53·5	6	8·3	31	23	27
VII.		Leicester (Belmont Villas)	1·72	...	·36	8	14	50·5	8	12·8	29	26	...
,,		Boston	2·71	+ 1·22	·56	7	16	50·0	8	8·0	30	24	...
,,		Grimsby (Killingholme)	2·65	...	·56	8	22	49·0	8	11·0	30	22	...
,,		Derby	1·90	+ ·35	·30	8	13	50·0	8	16·0	23‡	24	...
VIII.		Manchester	3·64	+ 1·31	·59	5	19	49·5	8	13·2	...	...	...
IX.		York	3·35	+ 1·55	...	...	...	...	...	...	...	...	...
,,		Skipton (Arncliffe)	5·71	+ 1·16	1·57	8	13	...	...	2·0	31	20	...
X.		North Shields	3·79	+ 1·59	·90	8	23	50·0	4, 5	6·8	30	23	30
,,		Borrowdale (Seathwaite)	7·34	— 9·61	1·26	4	12	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely)	5·66	+ 3·06	1·05	8	14	...	...	...	...	...	...
,,		Haverfordwest	8·09	+ 3·26	1·65	8	20	51·0	4, 5	11·3	30	22	24
,,		Rhayader (Cefnfaes)	3·17	— ·12	·90	11	...	...	...	10·0	30	...	...
,,		Llandudno	4·43	+ 2·23	·95	5	19	54·2	8	21·6	31	10	...
XII.		Dumfries (Crichton Asylum)	...	...	...	...	...	...	...	...	...	...	...
,,		Hawick (Silverbut Hall)	2·81	...	1·04	8	15	...	...	...	...	...	...
XIV.		Kilmarnock (Annanhill)	1·84	...	·44	5	10	48·6	5	18·0	24	26	29
XV.		Castle Toward	2·28	— 3·07	·40	12	12	50·0	4, 5	...	...	25	...
XVI.		Leven (Nookton)	2·02	— ·76	·39	8	15	49·0	4	8·0	29	29	30
,,		Stirling (Deanston)	...	...	...	...	...	...	...	...	...	...	...
,,		Grandtully	1·09	...	·14	9	13	...	...	...	...	...	...
XVII.	SCOTLAND.	Braemar	1·42	— 2·35	·25	11	18	42·8	5	5·0	29	29	31
,,		Aberdeen	2·76	...	·42	21	22	47·5	4	12·1	23	28	30
XVIII		Loch Broom	4·35	...	·73	10	18	...	...	...	...	...	...
,,		Portree	4·51	—11·12	·61	17	23	...	...	...	...	...	...
,,		Inverness (Culloden)	1·02	— ·91	...	...	20	50·0	4	14·1	31	28	31
XIX.		Helmsdale	3·79	...	·62	2	23	...	...	...	...	...	...
,,		Sandwick	3·44	— ·53	·58	3	22	49·8	4	22·4	31	15	22
XX.		Caherciveen Darrynane Abbey	8·17	...	1·15	23	21	...	...	...	...	...	...
,,		Cork	5·15	...	1·10	31	21	...	...	...	...	...	...
,,		Waterford	4·68	+ ·26	·90	28	19	50·0	4, 5*	27·0	15§	19	...
,,		Killaloe	7·99	+ 4·30	·95	5	23	...	...	...	...	...	...
XXI.	IRELAND.	Portarlington	3·41	+ ·22	·49	6	22	51·0	8	23·0	16	24	...
,,		Monkstown, Dublin	...	...	...	...	...	...	...	...	...	...	...
XXII.		Galway	5·83	...	1·14	10	24	53·0	8	25·0	27	18	...
,,		Ballyshannon	4·55	...	·67	5	17	...	...	...	...	...	...
XXIII		Waringstown	3·24	...	·64	8	16	51·0	4	19·0	22	27	29
,,		Edenfel (Omagh)	4·28	...	·74	8	18	46·0	8	17·0	30	27	...

* And 7, 8. † 31. ‡ 30. § 27. ** 20

+Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON DECEMBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

LINTON PARK.—A very wintry month; frost on every day, except 1st, 6th, 9th, and 12th, and the ground deeply covered with S on the 16th, and to the end of the month, with severe frosts on the 3rd, 20th, 23rd, 30th, and 31st, the last two days especially; the ther. fell to 12° which is lower than on any previous occasion here for 25 years, excepting Feb. the 10th, 1855, and Jan. 1867.

SELBORNE.—A most inclement month; the death-rate very high, even for Dec. The min. ther. lower than I have recorded it in December for 12 years. The max. also lower, than in any Dec. but 1870. The average min. during the last 10 days of the month was only 19°·03. The S has lain deep on the ground from the 16th to the end of the month; prevailing winds from 14th to 22nd, N. and N.E., before that date S. and S.W. On the 31st the ther. fell to 5°, at 5 p.m., at this station; at E. Tisted, four miles distant, it fell to 1°. Frequent fogs and white frosts during the month.

BANBURY.—On the 23rd the rime on the trees very beautiful, resembling pure white coral.

CULFORD.—An exceedingly cold month; mean temp. being only 30°·5. Gale of wind, with R, on 6th; and very stormy on 8th and 9th. Bar. very low about the 11th. S on eight days. Heavy fog on the 28th, and the trees, &c., festooned with hoar frost to an unusual degree on the last two days. The temp. fell to 7° on the 29th, and to 6° on the 31st.

BRIDPORT.—The fall of S on the 30th is almost unprecedented; it was universally 1 ft. deep, and in many places, on the hills, 5 or 6 ft. deep. A thaw set in on new year's day, accompanied by heavy R, which caused the highest floods known for years, and doing some damage to property.

BODMIN.—The mean temp. 38°·0, being 4°·3 below the average, and the rainfall of the month 2·28 above the average of 25 years. No S has fallen in Bodmin, and the frost as compared with other parts of the kingdom has been slight; the temp. falling only as low as 30°·0 on one day, the 3rd.

HAUGHTON HALL.—This has been the most severe Dec., both for frost and S, that we have had for 40 years (the period of my registration); the nearest approach was in that of 1844, when the average min. temp. was 29° (against 26°·5 this month); the S then was only 4 in. deep, whereas now it has been 9 in., on the night of 15th, followed by 3 in. on 23rd, and 1 in. on 27th. The ice on Christmas day was 6 in. thick. R daily, except on 2nd and 9th, till the 13th. The bar. fell suddenly from 29·47 to 28·34, on the 8th, followed by a storm on that night; it then rose to 29·34, falling again on the 11th to 28·32, with no result till the 15th, when 9 in. of S fell in that night (melting into ·64). From that day the frost was intense daily till the close, when at night the ther. stood at 14°. Only one day with sunshine; from the 21st, mist and fog.

ORLETON.—The temperature variable, with severe frost occasionally till the 14th, when winter set in; on the night of the 15th a great fall of S covered the ground 10 or 11 in. deep where it was not drifted, and remained without any steady thaw till after the end of the month. Another heavy fall of S and R occurred on the night of the 23rd. From the 15th to the end of the month the sky was generally cloudy, and the frost severe and steady. The mean temp. of the month was about 7°·5 below the average, and lower than that of any Dec. (except 1870), for the last 18 years. The bar. was very low (28·40 uncorrected) on the 11th. The downfall was chiefly S.

LEICESTER.—Very severe weather, especially during the latter part of the month. Mean temp. 31°·6. Bar. (reduced) 28·654 on 11th. Max. temp. on 29th 27·2; min. 12·8; mean 20°. Max. temp. on 30th 25·5; min. 14·5; mean 20°. Max. temp. on 31st 25·0; min. 13·2; mean 19°·1.

BOSTON.—Mean temp. of month 8°·0 below the average of previous 10 years.

A sharp frost set in at the beginning of the month, followed by a few days of higher temp. The cold weather set in again on the 18th, and continued to the end of the month; the temp. falling to 8° on the 30th. The river Witham commenced running again on the 4th, after several months' cessation. Rainfall for the year 4·16 below the average.

GRIMSBY.—A month of real winter weather, which was very severe at times, especially at the end of the month, but we had no high winds. Many birds starved to death. The temp. on the 1st of Jan., 1875, was as low as at the remarkable Christmas day, 1860, viz., 6·5; but the min. of this Dec. was 11°·0 on the 30th. The highest temp. on the day preceding was only 24°·5. Several redwings found starved to death on the 26th. Wild swans in the Humber on the 29th.

MANCHESTER.—Frequent R and S. Dense fog on 10th and 30th, and less dense on 23rd, 25th, and 26th.

ARNCLIFFE.—A very severe month; the longest continuance of frost ever registered here; deep S ever since Nov. 11th; a very wild night on the 8th, with 1·57 of R, the max. of the month.

WALES.

HAVERFORDWEST.—The month was cold from beginning to end, and very wet; much S fell; first fall about the 14th, which never melted from the high lands till the end of the month. Heavy snowstorm commenced at 3 a.m. on 29th, and lasted through the next day and night, followed by intense frost, and a gale from E.S.E., during which the S drifted to the depth of several feet; the frost was not severe till the last week of the month. A terrible gale occurred on the 8th and 9th, with great depression of the bar.; it fell from 30·019, 9 p.m., on 7th, to 28·651, at 9 p.m., on 8th. Great floods; heavy gale on the night of the 31st. Min. temp. 11·3 on 30th.

LLANDUDNO.—A cold month; mean temp. 37°·7, being 7°·8 below the corresponding month of last year, and 5°·7 below the average, 1861 to 1873, both inclusive; during these 13 years the mean temp. of Dec. never fell so low, except on one occasion (1870), when it reached 36°·5. No frost the first half of the month, and never more than a sprinkling of S, except on the distant hills.

SCOTLAND.

HAWICK.—A month of S, H, fog, frost and stormy winds. Hills white from the first to the last of the month; farmers at their wits' ends for food for their stock.

ANNANHILL.—A month characterized by a specially low temp.; a frost which for severity has not been equalled since 1860; a deficient rainfall. Winds light, except a severe gale on the 7th, and chiefly E. and N.E. But little S here; the hoar frost very beautiful, forming into unusually large ice crystals which glittered on the ground. Number of deaths this year 762, the highest number since the Registration Act came into force.

CASTLE TOWARD.—But little R or sun; S on the 11th, about 3 in. deep near the sea, and very deep on the hills. On the 15th and 16th another fall, about 2 in. deep, followed by very hard frost; lowest temp. 17°. Ice 4 in. thick from the 22nd to end; frequent fog on land, and still more dense on the water. River steamers delayed with the mails.

ABERDEEN.—A month of bitterly cold weather, the ground round Aberdeen white with S on 25 days. Rain, bar. and temp. all below the average, the latter being 6°·1 below the mean of 18 years.

PORTREE.—The month has been the most severe ever experienced here; the frost is most intense, everything is frozen up into a sheet of ice. The sheep are ill off, they cannot scrape any food for themselves.

SANDWICK.—With the exception of four partial thaws, we have had frost and S during the whole of December, which is unprecedented in our insular climate, and caused by the absence of W. wind. The roads are like glass; several severe accidents have occurred from falls. The strongest gale was on the 4th—68 miles an hour. T and L on the 5th.

IRELAND.

DARRYNANE.—1st and 2nd, fine and frosty, with N.E. winds; 3rd to 12th, N.W. winds and showery, except on 10th, when the wind was S.E.; fresh gale and heavy sea on 11th and 12th; 13th to 31st, winds moderate and variable, chiefly N. S on mountains on 13th, 17th and 31st, a good deal on the last day; H on 6th, 9th (heavy) and 16th; frost on 1st, 2nd, 14th, 17th, 26th, 27th and 28th.

WATERFORD.—Great storm on the 8th.

BALLYSHANNON.—The month has been an unusually severe one. Falls of S, frequent frost, storms and R alternating, and the temp. throughout considerably below the average. Gale from N.N.W., T and L and showers of sleet on 6th, and a strong gale from E.N.E. on 31st.

WARINGSTOWN.—Early part of the month wet; frost set in on 13th, and, with occasional intermission, lasted to the end, but was never very intense; little or no S lay here.

EDENFEL, OMAGH.—Weather to 10th very wet, and inclement the remainder of the month; chiefly hard frost with S except during frequent short intervals, when rapid variations in temp. occasioned heavy R, to be again immediately followed by frost.

SUPPLEMENTARY TABLE OF MONTHLY RAINFALL, DECEMBER, 1874.

Div.	County.	Station.	Total Fall.
			in.
II.	Kent	Margate (Acol)	2·45
,,	Sussex	Hailsham	2·40
,,	Hampshire	Strathfield Turgiss	1·68
III.	Oxford	Oxford (Magdalen College)	1·88
,,	Cambridge	Cambridge (Merton Villa)	1·89
IV.	Essex	Harlow (Sheering Rectory)	1·73
,,	Norfolk	Swaffham	2·23
V.	Devon	Teignmouth (Brookbank)	5·17
,,	,,	Torrington (Langtree)	6·29
,,	Somerset	Taunton (Haines Hill)	3·35
VII.	Leicester	Melton Mowbray (Coston)	1·89
,,	Lincoln	Horncastle (Bucknall)	2·34
VIII.	Lancashire	Liverpool (Walton-on-the-Hill)	2·70
IX.	York	Wakefield (Stanley Vicarage)	2·30
X.	Durham	Gainford	3·70
,,	Westmoreland	Shap	3·48
XVII.	Banff	Keith	2·78
XVIII.	West Ross	Strathconan	4·21
XX.	Cork	Fermoy (Glenville)	7·31
XXI.	Westmeath	Athlone (Twyford)	4·44
XXII.	Galway	Ballinasloe	4·17

NOTE. *Gainford*, Observer reports that his return for September should have been 2·56, and for October 1·96.

END OF VOL. IX.